WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2003ND27B

Title: Modeling Groundwater Denitrification by Ferrous Iron Using PHREEQC

Project Type: Research

Focus Categories: Groundwater, Models, Nitrate Contamination

Keywords: Groundwater, Denitrification modeling, PHREEQC model

Start Date: 03/01/2005

End Date: 02/28/2006

Federal Funds: $13,650

Non-Federal Matching Funds: $28,804

Congressional District: At Large

Principal Investigator:
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Abstract

Nitrate is one of the most common groundwater contaminants and only denitrification converts it effectively into harmless N2. Availability and reactivity of electron donating species is the limiting factor for the natural reduction of nitrates. The long term objective of the UND denitrification team, working closely with the North Dakota State Water Commission and the North Dakota Department of Health, is to develop a state-wide assessment tool (which would also be useful on a regional basis) to quantify the ability of aquifers to denitrify based on the supply of electron donors in aquifer sediments. In the past seven years the team has made significant contributions toward that goal with respect to our understanding of the contribution of sulfide and organic carbon toward aquifer denitrification. However, a major obstacle for us is determining the contribution of ferrous iron to denitrification in regional aquifers. It appears that ferrous iron is the major electron donor at some of the sites in our in situ mesocosm (ISM) network; nevertheless, unlike organic carbon and sulfide, the geochemical evidence for ferrous iron is more difficult to demonstrate because ferric iron precipitates out of the aqueous solution. Thus, it is essential that we use geochemical modeling to understand the hydrogeochemistry of our research sites to determine if denitrification by ferrous iron is indicated by the complex evolution of water quality parameters observed in the ISMs. Moreover, identification of sediment Fe(II) minerals through chemical extraction, x-ray

diffraction, and Mössbauer spectroscopy are employed to complete the input data for the PHREEQC forward and inverse modeling schemes.